ABSTRACT

Advanced processing techniques can be used to enhance the robustness, efficiency, and quality of several parallel imaging techniques, such as SMASH, SENSE and subencoding. Specifically, a magnetic resonance image is formed by measuring RF signals in an array of RF coils, forming a set of spatial harmonics and tailoring the set of spatial harmonics to form a set of tailored spatial harmonics that are adjusted for variations in at least one of angulation of an image plane, field of view, and coil sensitivity calibration. The harmonics may be tailored by selecting automatically a subset of the set of formed spatial harmonics, adjusting the set of spatial harmonics by a function not equal to 1, to adjust for sensitivity variations along a phase encode direction, and/or performing separate spatial harmonic fits of the coil sensitivities at different spatial positions to the set of tailored spatial harmonics. The magnetic resonance image may also be formed by generating a set of encoding functions representative a spatial distribution of receiver coil sensitivities and spatial modulations corresponding to the gradient encoding steps, transforming the set of encoding functions to generate a new set of functions representative of distinct spatial positions in the image, and applying the new set of functions to a set of MR signals to form the magnetic resonance image. Matrices inverted during the process of forming the magnetic resonance image may be conditioned by thresholding the eigenvalues of the matrix prior to inversion.